FACTS
FOR ENVIRONMENTAL STUDIES

Ontario
Ministry of the Environment

SET 4E

TAKING A CLOSER LOOK AT SNOW

AQUATIC HABITAT STUDY

LAWN STUDY

A LESSON PLAN FOR STUDYING SOIL

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FACTS FOR ENVIRONMENTAL STUDIES

Ontario Ministry of the Environment

TAKING A CLOSER LOOK AT SNOW

I New Snow

During the cold winter months, snow crystals begin to form in a layer of the atmosphere, some nine to ten kilometres above the earth, where the temperature is approximately -34.4 to -37.2°C., and where there are cirrus clouds and only a small amount of water vapor. The crystals develop from water molecules which stick to the microscopic particles of salt or dust carried into the atmosphere by the wind. In its earliest form, a snow crystal is merely a plain hexagonal shape of transparent ice.

As the crystal falls through the various layers of clouds in the atmosphere, more water molecules stick to it and form six arm-like extensions. Ice fills in the empty spaces and the process continues -- six more extensions, spaces fill in, etc. As the crystal gets closer to the earth, it grows more rapidly due to the increasing amount of water droplets, created by warmer temperatures.

The crystal then falls through the nimbostratus clouds, where the temperature is between -15 and -12°C. It continues to float back and forth, continuously growing until it reaches about .4 cm. in size and is heavy enough to fall to earth.

Activities:

1. Have the students collect freshly falling snow on a dark cloth or locate new snow on a dark surface. Have them examine it carefully.

   Ask - Is each snowflake the same?
   - Are there basic types of snow crystals?
   - Do any of the flakes appear broken?
   - What may have caused them to break?

2. Make slides of snow crystals for future discussion or art classes.

   Equipment - microscope or projector slides
   - cardboard
   - clear plastic or laquer spray
   - viewers (microscopes, slide projector)

   Method:
   1. Store the slides and laquer in the freezer until a snowfall.
   2. Quickly take the slides outside before they have an opportunity to warm up. Note: Hold each slide on a small piece of cardboard so that your body heat does not warm up the slide.
   3. Spray thin coat of laquer on slide and hold slide out in snow until several flakes have fallen on it.

4. Leave the slide outside in the cold, away from falling snow for one hour while it dries.
5. When the slides are dry, bring them inside for viewing.

II Old Snow

Although snow falls as delicate crystals, it is transformed into granular crystals due to an evaporation and recondensation process -- the fine points evaporate and this evaporation causes the air around the crystals to become moist. The moisture then recondenses and deposits particles of ice on the flatter, smoother crystal surfaces.

Smaller, rounder crystals are easier to ski and toboggon on because they roll under a moving object in an easier manner than do the more sharply-edged new snow crystals.

Activities:

Have the students take samples of old and new snow and note any difference in their shapes.

Ask - Did the snow closest to the ground (the old snow) fall in the same shapes as we now see it?

III Snow Drifts - shape and structure

Select a drift with a good shape and an overhang (called a cornice). Only two people to a drift. Using a ruler or clipboard, slice the drift so a cross-section is exposed.

Activities:

1. Have the class examine and sketch the various layers (called strata) of snow, which are exposed. They may locate:

thick layers	dirty layers
thin layers	ice layers
clean layers	crusty layers

2. Have the students try to determine what caused these layers.

IV Snow Temperatures

Because of the reflection from the snow's shiny crystals and the air spaces between the crystals, heat cannot move through snow. Thus it is a good insulator.

A layer of snow covering the ground will keep the soil temperatures fairly constant during the winter, even if the air temperature changes greatly. On a very cold day, the snow helps maintain a 17°C. between the air and soil. On a warmer day, the snow keeps the soil cooler than the air.

Activities:

1. Using the drift cross-section, take temperature readings at five different depths by inserting the thermometer horizontally into the drift. Measure the position of the thermometer from the top of the drift and indicate it on the drift diagram.

2. Indoors - plot a graph of depth versus temperature.

3. Play a game to see who can find the warmest or coldest spot in the school yard.

4. Dig down to note the condition of the soil. Is it frozen or not? What is the color of the grass?

   Ask - If the snow is frozen and if plants cannot grow when they are frozen, how do the students think that spring flowers can grow through the snow? (The soil is not frozen.)

V Snow Density

Problems to pose:

1. Which melts faster, an ice cube or a snowball both weighing the same amount?

2. How many cups of snow are needed to make one cup of water? (Freshly fallen snow has a lot of air between its crystals: it may, therefore, take up to ten cups of snow for one cup of water.)

3. Will 30 cm. of newly fallen snow still measure 30 cm. in depth a week later?

4. Stick a snowball on the end of a pencil. Ask the class how long it will take for the first drop of water to fall off. (The porous nature of snow allows water to soak in between the crystals.) It may take up to one hour.

VI Snow and Pollution

As snowflakes fall through the atmosphere, they may pick up dust and small particles emitted into the air by industries. Snow lying near roads and packing lots may also become dirty due to the pollutants from car exhaust systems.

Activities:

Ask - Are there any other ways snow can become dirty?

1. Test how clean is the snow.

   Equipment - clean container, saucer, or glass
   - filter paper or paper towelling
   - funnel
   - clear jar or container
   - hand lens

   Method: 1. Wait until a snowfall and then collect snow in the container. Cover the top so that no dust can settle into it and wait until the snow melts.

2. Check the paper towelling for any specks and then place it in the funnel.

3. Pour one-half of the melted snow through the towelling and funnel into the jar.

4. Examine the towelling or filter paper with a hand lens.

5. Compare the melted water with the filtered water.

Ask - Why is it important to examine the filter paper before pouring the melted water through it?
- What can you see on the filter paper?
- What do you think caused the particles on the filter paper?
- What differences can you see between the melted water and the filtered water?

You may wish to continue this experiment by collecting snow from various areas of the school property and comparing it.

VII Other Winter Activities:

1. Using overhead transparencies, trace fresh animal tracks in the snow.

2. Investigate deserted bird nests to see how they are built.

3. Set up bird feeding stations. Observe and record the birds that feed on them.

4. Collect weather data.

5. Hold a winter carnival for the school.

6. Write a poem.

7. Make a collage about snow.

8. Using powdered tempera paint and a container with holes in it, make a snow painting in the school yard.

FACTS FOR ENVIRONMENTAL STUDIES

Ministry of the Environment
Ontario

AQUATIC HABITAT STUDY

INTRODUCTION

In this activity students are put in contact with a community of life as illustrated by an aquatic environment. By exploring an area of a pond or stream for plant and animal life, and by looking at the physical setting, students are made aware of the interrelationships that exist among these components.

Aquatic communities can be found in two areas: (1) in standing water such as ponds, lakes, and swamps, and (2) in running water such as rivers, creeks, and streams. The degree of water movement has much to do with the kinds of organisms existing in these communities.

As running water habitats are typical of what is usually accessible to most schools, many concepts in this study will deal exclusively with the stream environment. However, many of the general procedures can be used with students who are examining standing water habitats.

To carry out the following activities, the students should work in teams of two or three. Each group will study a 15-foot section of the stream by: (1) observing the physical surrounding, and by (2) sampling organisms found on the surface, directly in the water, on or in the bottom sediment, and along the shore. The data derived from these activities will provide information for discussion and for further investigation, if desired.

OBJECTIVES

The general theme of this learning experience is that fresh water habitats are natural environments in which communities of both plants and animals live. This theme is based on the following concepts:

1. Animals and plants can be found in almost any body of fresh water, whether it is temporary or permanent, large or small.

2. Some animals and plants are so tiny that we must use magnifying instruments to see them.

3. Aquatic habitats provide the plants and animals that live in them with all of their basic life needs.

4. The community that we live in has many different people -- doctors, teachers, street cleaners, and truck drivers. It also has many different types of buildings -- schools, stores, hospitals, and our homes. We need food, shelter, and sometimes medicine in order to survive. There are many different kinds of communities in the world. The one we are going to study is found in a stream or lake.

At the completion of this study, the students should be able to:

1. Recognize microscopic plants and animals.

2. Recognize aquatic habitats as homes for many different plants and animals.

3. Determine what forms of life are present in water and where to find them.

4. Describe several different physical features of the stream.

PRE-FIELD TRIP PREPARATIONS

Choosing a Field Site

Prior to beginning the field activities, the instructor should decide on the stream site where the class will carry out its investigations. The students will need to wade in the water. Therefore, the stream should be slow moving and shallow enough so that it does not present a danger to the students. Avoid ecological or environmentally sensitive areas such as waterfowl breeding grounds, sites where the shoreline is eroding, or areas with little or no shoreline vegetation.

A stream that has a very muddy bottom tends to become murky when students work in it and poor samples are usually obtained. A slightly stony and pebbly bottom is a good choice. An ideal stream is anywhere from 5 to 35 feet wide and no deeper than 3 feet.

The length of this study will depend on how many parameters of the aquatic habitat you choose to examine. An hour-long session in the field, supplemented with hour-long class preparation and follow-up sessions, is the minimum amount of time you should plan on using. Students' enthusiasm in the field runs high and it is often difficult to maintain a time limit on this activity.

Building the Equipment

Materials

1. Plastic pails with handles (gallon size): Ice-cream, frozen fruit, or honey containers are also ideal. One for each team.

2. Sorting trays: White or light colored dishpans are best choice, shallow aluminum foil baking dishes such as TV dinner containers or pie plates may be used. Aquatic organisms show up well against a white background so if aluminum containers are used, the bottoms should be painted white, or cut heavy white cardboard to fit inside the container. Several large sorting trays are needed for the instructor with each team possibly using a smaller tray.

3. Old spoons or hand trowels (optional): One for each team.

4. Waterscopes: May be made from heavy cardboard cylinders about half a metre in length. Mailing tubes, stove pipes, poster or paper containers are ideal. If cardboard cylinders are used they will need to be waterproofed with polyurethane or a plastic varnish. A bottomless bucket is also useful. Cellophane or clear plastic is needed to fit over one end of the tube. Instructions for use and assembly follow.

5. Microscopes (optional): Magnifying lenses are more practical for use in the field. Strings should be attached so the students can hang them around their necks. One for each team.

6. Eye droppers and basters: Two sizes are preferable.

7. Collecting Nets: Hand dip and flat-bottomed nets. Although one net may be shared between several teams, one net per team is desirable. Nets may be made from coat hangers, nylon stockings, cheesecloth, tape, and wooden stakes such as broken hockey sticks or broom handles. Instructions for use and assembly follow. Plankton and seine (minnow) nets may also be used.

8. Bottom samplers: For screening the bottom material an ideal collecting tool is a kitchen seive or strainer. A hand screen may be used which consists of a piece of screen tacked onto a wooden frame. Each team requires one seive. Instructions for the use and assembly of the hand screen follow.

9. Containers: Small containers such as empty tin cans. One for each team.

10. Rubber boots: These may not be necessary if weather conditions are suitable to allow students to wade in the water in their bare feet.

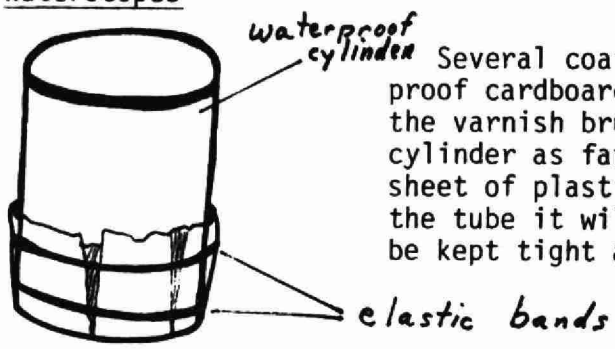
11. Clipboards, paper, and pencils: Clipboards of thin plywood or heavy cardboard with paper and a pencil attached are needed for each team.

12. Field guides: A general identification key will benefit the students while in the field. The Golden Nature Guides has a publication entitled Pond Life, which is ideal for identifying some of the more common life forms the students will find. As it may not be feasible for each team to have a guide such as this, suggestions on how they could prepare one of their own before the field trip follows.

Assembly Instructions

Students should bring as many tools and materials from home as possible and be given time to construct the equipment at school.

Waterscopes



Several coats of plastic varnish will be needed to waterproof cardboard cylinders, if they are used. When applying the varnish brush it up into the inside surface of the cylinder as far as you can reach with the brush. Cut the sheet of plastic so that when it is placed over the end of the tube it will extend 5 or 6 cm. up the side. This can be kept tight and secure with elastic bands.

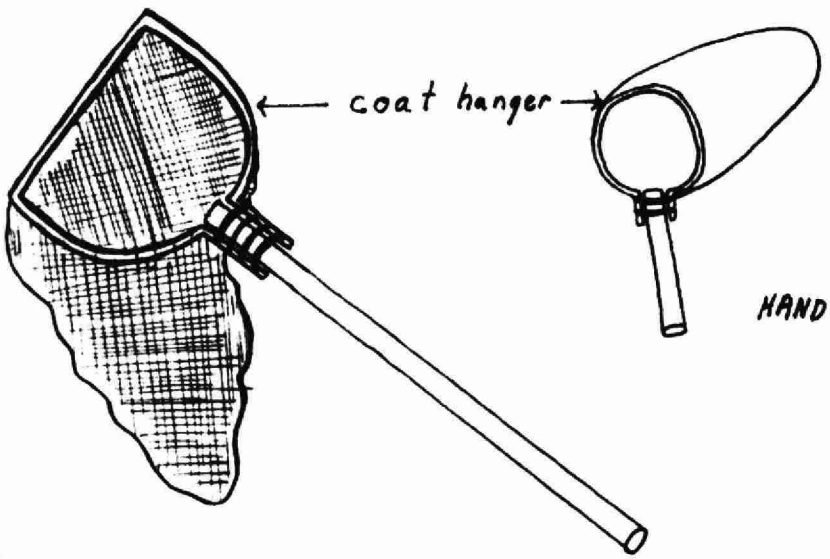
The waterscope may be used to look at the tiny animal and plant life on the stream bottom as it exists naturally. The pressure of the water causes the plastic to become a convex lense so that plants and animals appear larger than they really are.

The success of viewing through the waterscope will depend on the brightness of the overhead sunlight and the clearness of the water.

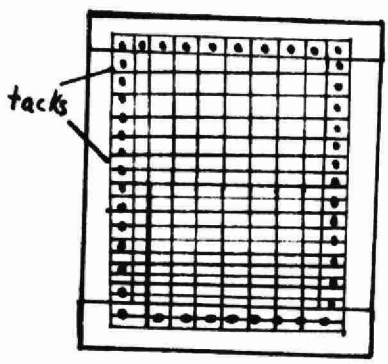
Collecting Nets

Small hand dip nets are primarily used for collecting insects and other small aquatic life on the surface of the water, among plants, and under stones and logs along the shore. A circular frame is needed for attaching the net bag. Bend a coat hanger into a ring about 8 cm. in diameter. The students may also bring rings from home such as an embroidery hoop or stove-ring. Make a net bag from organdy, nylon stockings, or cheesecloth about 12 cm. deep. Sew the bag onto the ring. Fasten the ring and bag to a stick or pole about 8 cm. in length.

A flat-bottomed net is used to collect larger aquatic organisms throughout the water column. Bend the coat hanger wire into a D-shaped frame about 35 cm. in diameter. Make a net bag from cheesecloth, nylon stockings, or netting of a 3 mm. mesh, about 60 cm. in depth. Sew the bag onto the frame. The frame and net bag can then be attached to a long pole of up to 90 cm. in length with tape. A broom handle or hockey stick is ideal.



HAND DIP NET



HAND SCREEN

FLAT-BOTTOMED NET

Hand Screen

A frame can be built using pieces of wood about 30 cm. in length. A mesh hardware screen of less than 1 mm. is tacked onto the frame. Bottom mud samples are then dug up and placed on top of the screen. Water is poured over it washing the finer particles through. Large stones should be removed by hand.

Identification Guides

Before entering the field, the students should be introduced to aquatic habitat concepts and the physical features of the stream should be discussed.

Illustrative drawings of the aquatic plants and animals should be made either on the blackboard or in poster form. Students need to be made aware of what they may find and where to look. They could make up their own identification key and attach it to the clipboard. References such as the Ministry's educational fact sheet on "Aquatic Insects" could be used.

It should be stressed to the students that they are only guests in the aquatic community and, therefore, they should return all specimens to the water as close as possible to where they found them. Overturned rocks should be replaced in the same position, and plants that are removed should be pulled up with the roots intact and replanted when observations are made.

FIELD TRIP ACTIVITIES

All of the following activities could be undertaken during one field trip or could be spread out over several visits. Although the sequence can be altered, a team should complete an entire activity before preceding to another stage.

A question guideline follows each activity. It is suggested that the students answer these or other related questions designed by the teacher, while they are in the field.

I Microscopic Pond Life

You will need lenses, basters, sorting trays, and clipboards. One of the most fascinating aspects of animal life involves the discovery of microscopic plants and animals in a sample of water. Most small children have not been exposed to these forms and are generally thrilled to discover them. The richest collections will be found early in the fall and again in the spirng.

Using the baster, have the students suck up a sample of water from: (1) the edges of the stream or pond, (2) the scum on the surface of rocks or logs found close to shore, and (3) close to the bottom mud. Transfer these samples to separate small sorting trays on shore. Have the students observe their samples with magnifying lenses and ask them to draw the specimens they see. When observations are completed, return the samples to the water.

Question Guideline

Do you see anything moving? What color is it? How fast is it moving? How does it move? Do you see other forms? Are they the same color? The same size? The same shape? Are they plants or animals?

II Small Aquatic Animals

You will need small hand dip nets, pails, small containers, sorting dishes and trays, clipboard, seives, and waterscopes.

Insects and small aquatic animals will be found on the surface of the water, on and under plants, logs, and rocks, in the bottom sediment, and directly in the water.

Have the students look for insects such as the water strider on the surface of the water. Using the hand dip nets they can catch and put them in pails which are half-filled with water. Identify and record observations.

Using the hand dip net, sweep it through the water around rooted vegetation. Put any captured specimens into the bucket. Look under leaves of plants, such as the water lily, and along the stems of plants for insects. They can be caught with the net and transferred to a pail. Identify and record observations.

Have the students turn over rocks and small pieces of wood in the water and, using the waterscope, look closely for any movement. Common forms such as the mayfly or stonefly nymphs and leeches may be found.

Organisms found on the rocks can be washed off by holding the rock over the pail, and pouring water over it gently. Identify and record observations.

Students are usually amazed to find living things in the bottom mud. They should be able to observe several organisms, particularly the bottom tube dwelling worms.

The students can obtain a mud sample by either digging up the mud with the kitchen seive or using spoons and placing it on the hand screen. Look closely for any movement. Fill the small container with water and pour it gently over the mud. Can you see anything? Pour several containers of water through the mud. The remaining sample can then be dumped into the pail (half-filled with water). The magnifying lenses may be of some help now if students fail to observe any movement. Note: many aquatic worms are small and are clear or have a very light coloring. Identify and record observations.

The small dip net can be pulled through the water, just below the surface and then closer to the bottom of the pond or stream. Contents of the net are then to be transferred to the pail for observation and recording. The waterscope may be used here to observe the life as it exists naturally in the water.

Question Guideline

How do the insects found on the surface of the water move? What do their legs look like? Do they make particular noises? Do they ever dive into the water?

What color are the insects found on the plants? Why would a plant be a good home?

What color are the organisms that are found on rocks? Why is this important? How do they attach themselves to the rock? Is the rock green and slimy? Why is this? Why would a rock be a good place to live? What differences do you see when the organisms are held in the air (only for a few seconds, we do not want to harm them) and when they are put back into the water?

What color are the organisms that were found in the mud? Why is this? What kinds of food would they find in the mud? Why is this? Where does it come from? Do you think these organisms could live on a plant or on a rock? Why not?

What makes the organisms which live throughout the water different from the other ones that were found on the plants? What do you think they eat?

III Large Aquatic Animals

An ideal tool for collecting small fish is the seine (minnow) net. If this is available for the class to use, an excellent fish study could be undertaken. The net needs to be unrolled and placed across the stream with floats up and weights down, allowing it to take a U-shape. Have several students go upstream from the net and walk towards the ned moderately splashing and kicking to encourage the fish to go downstream into the net. Bring the net towards the shore keeping the weighted bottom tight as it is lifted out of the water.

Fish, crayfish, and large beetles may be caught and can be transferred to a pail full of water. Identify and record observations. A fish's scales have observable ridges which can be counted as growth rings. Return all captured fish immediately after observations have been made.

The flat-bottomed nets are successful for collecting large specimens. Have the students sweep the net back and forth among water plants and along the bottom of the stream or pond. The students can also walk upstream for a distance with the net dragging behind them, another student can walk towards them. The net is then pulled up and the contents transferred to a pail. Identify and record observations.

Have the students walk along the bank and look for any signs of animal life such as tracks and holes in the ground indicating a burrow. If the pupils anticipate viewing large animals such as racoons, muskrats, or turtles they may be disappointed. They will be very fortunate, if they do.

IV Plant Life

Have the students examine plants from several distinct areas. Look for vegetation that is growing on submerged rocks and logs. Find plants that are floating or drifting in the water. Several species of plants that are rooted in the bottom mud and growing out of the water should be examined. Remind students that plants may be pulled up with the roots but will have to be replanted. Observe the plants growing directly next to the water on shore, several metres away and then about 20 metres away. Identify and record.

Question Guideline

What differences are seen between the plants? How are the plants adapted to their particular area? Are they all the same color? Do they all feel the same? Do they look different when they are taken from the water? Could the plants taken from the water live on the land?

V Physical Features of the Pond or Stream

Although physical parameters such as temperature, depth, width, and velocity could be studied by older students, a general description of the stream is better suited to younger students.

Have the students record and describe the following characteristics:

1. What color is the water? Is it clear, light brown, or dark brown? Can the bottom be seen?

2. What does the stream bank look like?

3. Describe the surrounding country.

4. Estimate the amount of shade on the stream. Is it all shaded or half shaded? Why is it shaded?

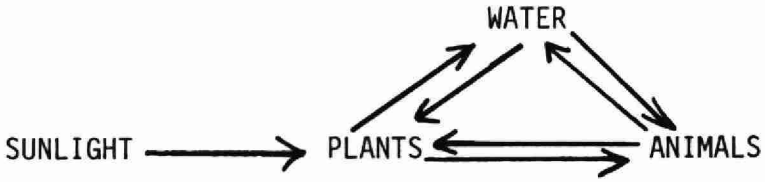
5. What is the weather like?

DISCUSSION OF RESULTS

As the teams may collect different samples, it will benefit the students if the teacher takes the best samples from the students' pails and transfers them to the large sorting trays. The students can then take turns recording their observations.

At the end of the field work, the students should share their thoughts and experiences on the aquatic environment with the rest of the class.

The class should think about the initial concepts that were covered at the beginning of the study. The following diagram illustrates interactions taking place in the aquatic habitat. The arrow represents the words, "interacts with".



ADDITIONAL ACTIVITIES

1. A classroom ecosystem could be constructed. Refer to the Ministry's educational fact sheet, "Constructing a Classroom Ecosystem".

2. A mural of the aquatic habitat could be drawn, painted, or constructed by the students.

3. An essay could be written on a typical day in the life of a plant or animal that was observed in the stream.

FACTS FOR ENVIRONMENTAL STUDIES

Ontario Ministry of the Environment

LAWN STUDY: AN EDUCATIONAL FACT SHEET

Introduction

In this activity students are put in contact with a community of life as illustrated in the field. By exploring an area of a field for plant and animal life and by looking at the physical environment, students are made aware of the interactions between these components. A follow-up could extend into the areas of climatology, soil studies, botany, zoology, arts and crafts, and creative English.

The field work is most suitable for two students working in one quadrant with a maximum of fifteen students working under one teacher. This study takes approximately one hour.

The questions listed in the procedures section are merely suggestions and should be adapted to the age level of the students.

Equipment

1. tent pegs, wooden stakes, or popsicle sticks (four for each group)
2. string
3. thermometers
4. magnifying lenses (optional)
5. measuring tapes or rulers
6. paper and pencils

Procedure

Before entering the field, the teacher should take time to explain the following:

A. how to set up a quadrant (instructions are given at the end of the fact sheet)
B. what to look for
C. what to record
D. what characteristics to measure

Ideally the study should be initiated in an area where a blackboard or a flip chart is available for the teacher's use.

1. To lead into the activity ask:

   (a) What kinds of things will we find in the quadrant?
   (b) What kinds of animals will we find on the ground, in the ground, or flying over the ground?

   List the classes' responses on the board for later referral and comparison. In this way a discussion can be centered on why all things may not be able to exist in the area.

2. The students should then be divided into groups of two or three and the equipment distributed. Either allow the students to pick their own study area or assign them to a specific location.

   It will be more beneficial to the students if the quadrants under class study differ in some way. Quadrants set up under trees will reveal a different community than ones set up on a hill or in an open field.

   After the students have set up their quadrant, the teacher should visit each one.

3. The students should make general observations about the area in their notebooks.

   (a) What type of terrain is the quadrant in? Is it open and flat or is it steep and rolling?
   (b) Is it sunny and hot or shady and cool?
   (c) Is it windy or is it calm? What direction is the wind blowing?

4. Specific characteristics of the vegetation and animal life found in the quadrant should be recorded.

   Vegetation

   (a) Is the width of all grass blades and their heights the same throughout the plot? Is there more than one species of grass?
   (b) Can you find different colors of vegetation?
   (c) If seeds are present, how did they get there and where did they come from?
   (d) Are the plants in the quadrant low growing or creeping, or are they bushy and tall?
   (e) Can you find any dead or decaying vegetation? Why is it important?
   (f) If dandelions are present, are they in flower or have they all gone to seed?
   (g) Can you find any clover with more than three leaflets?
   (h) Is moss found in dry or moist places? What does it feel like?
   (i) Are there any wildflowers in your quadrant? Do they have a strong or a weak scent? Why is this important?
   (j) By looking at the down in the flower heads of thistles and the spines on the leaves, how do these features adapt it for survival?

   Animal Life

   (a) Do you see any insects such as bees, wasps, flies hovering over a particular type of vegetation?
   (b) What kinds of sounds can you hear?
   (c) Are there any insects such as aphids, grasshoppers, or leafhoppers on the plants? Are they moving? How fast do they creep?
   (e) Can you find the same insects in both short grass and in long grass?
   (f) Have the pupils get down on their hands and knees and carefully part plants so that they can see the ground surface. Spiders, beetles, land snails, slugs, larvae, mites may be found. How are these animals suited to their environment?
   (g) Can you find any evidence of animal life such as worm castings, worm holes, ant hills, or spider webs?

5. Physical characteristics of the quadrant should also be examined.

   (a) Is the soil wet, moist, or dry? What color is the soil? Looking at the particle size, texture, and porosity of the soil, how might these features affect the animal life?

(b) Have the students take the temperature on the ground and about four feet above the ground. Does the temperature difference play a role in the survival of life in the quadrant? Compare temperatures taken with students.

Records

Students should record what they have found, heights of vegetation, temperatures, and a description of the geographical setting. A study sheet with these headings printed out may be distributed to each student, if desired. Drawings may be made of the quadrant and of vegetation or animal life that was found.

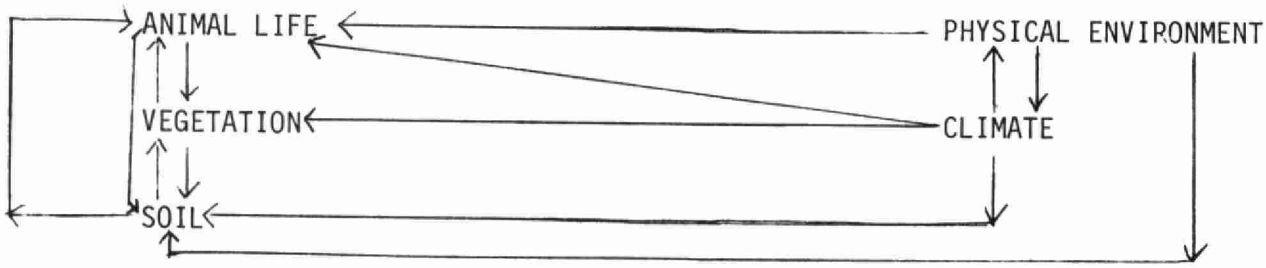
By counting the number of different species in the quadrant, students can contrast their population densities with others and discuss reasons why these differences occurred. It is not essential that every blade of grass be counted but by a general survey it could be determined for example that the quadrant consisted mostly of clover.

Follow Up

After the field work has been completed, results can be compared and discussed with the entire group.

Summary

This model illustrates how the different characteristics studied in the quadrant can affect each other.



NOTE: It is wise to have on hand for the students' use identification guides for flowers, insects, and weeds.

Setting Up A Quadrant

1. Using a tape or ruler measure out one metre on the ground.
2. Push a tent peg into the ground at either end of the tape.
3. Pick up the tape and lay it down at a 90 degree angle from the previous peg.
4. Repeat previous steps until all four pegs are positioned.
5. Between all the pegs string can be tied to complete the quadrant.

FACTS FOR ENVIRONMENTAL STUDIES

Ontario Ministry of the Environment

A LESSON PLAN FOR STUDYING SOIL

Introduction

The following soil study has been designed for students at the primary/intermediate level to make them aware of the various properties of soils and to provide them with a greater understanding of the importance of soil as a life supporting system. The activity, while allowing the students to gain more knowledge about the soil, at the same time forces them to make use of their senses and increases their appreciation of their surroundings.

This study, can be adapted to other age levels. For example, a more advanced soil study could involve determining the soil type of an unknown sample. Further testing of soil porosity, water holding capability, acidity, etc., will enable students to understand the different physical and chemical characteristics of each type.

The activity should be conducted in an outdoors setting with no more than 15 students working under one teacher. It should take approximately one hour.

Equipment

newspaper, spoon, hand lens, soil samples from different areas

Procedure

1. Begin by handing each student a sheet of newspaper and a spoon. Instruct the students to choose an area either in a field, forest, or near a body of water; explain that it is necessary to obtain samples of soil from different areas to see if any differences may exist. The students should dig down several inches and gather three or four large handfuls of soil.

2. Upon returning with their soil, allow the students to examine the soil samples for at least fifteen minutes. A discussion can follow based on questions put forth by the teacher. The type of questions asked should require the students to observe the various properties of the soil. Ask students to draw and if possible write down the different things which they find in the soil.

   ### Sample Questions

   A. What is the soil made of? Did you see anything that makes you think that the soil is made of these materials? (If children do not suggest that rock crumbles into soil, ask questions such as: what happens when you rub two stones together?) What causes the rock to break down into soil? Can you find any rocks which show signs of weathering? Are there any particles present? What are they? Were these particles always this size or have they changed? If you think they have changed, how did this change occur? What else, other than rock is needed for soil?

   (Answer: decaying leaves, wood, dead organisms are also needed.)

B. Ask the students to describe what their soil looks like? How does it feel? Squeeze a handful of soil: compare the texture, the way the soil holds together. When you press a large piece of soil in your hand does it squash, or does it break up easily, or does it require more pressure? Why? What differences can you see between the different samples of soils? (CColor, texture.) What do you think causes these differences?

C. Smell the soil: Does it have a smell? What does it smell like? What do you think causes the soil to smell? Take a handful of soil from near the surface. Squeeze it, holding your hand near your ear as you do so. Do you hear anything? Describe what you hear.

D. If you were going to make the very best possible soil for growing plants and trees, what would you put in it? Why? Are rock particles of any value to the soil? Why? Are animal particles of any value to the soil? Why? Are plant particles of any value to the soil? Why?

3. Further observations may be made by pouring water on soil and observing what happens. Was the water absorbed? How quickly? Why does water soak into some soils faster than others? If the water was not absorbed into the soil, where did it go? Did anything sink into the soil with the water?

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The Soil Game

Separate the class into two groups (five to eight students in one group, the remaining students in the second group). Assign the title "clay particle" to about one-third of the individuals of the larger group. Assign the title "silt particle" to some individuals and "sand particle" to those remaining. The second group will become a "plant part," except for one or two students who will be the animals who live in the soil.

Place the "sand, silt, and clay particles" in a disorganized clump -- individuals stand at arms length. Explain that the soil is mixed in this way: that space between the particles is filled with air, water, plant roots, organic material (decomposing), and animals. Will the soil be different, if most of the particles are clay? Or sand? Or silt? A soil that contains about equal parts of each is called a "loam" soil; one containing mostly clay is termed a fine-textured or clay soil, etc. All students hold their positions.

After this is understood, create a plant root by arranging the individuals of the small group (five or six) in a straight line, have them hold hands, and move apart until their arms are extended. The leader of this line represents the "growing point" of a plant root and he weaves his way through the spaces in the soil clump until he reaches the other side of the group. Stop and hold this position.

In order for the students to understand that the plant root takes minerals and plant food from the soil particles, water and air from the open space, and anchors the plant growing above, ask questions such as: What does the plant need to grow? Where does it get it from? How else is the soil important to the plant? The individual animals now move about through the open spaces finding food, shelter, and water. (Bacteria, molds, and other small creatures are included in the term -- animals.) Following further discussion whereby the students express their experience by talking, ask them to demonstrate how the plant root and animals would move through soil which is entirely sand and soil which is entirely clay. Possible questions which could be asked include: What differences do you notice between sand and clay? Do you think plants and animals could survive very easily in soil which is entirely sand or entirely clay? Why or why not?

At another time, repeat the above activity and ask, "What happens when rain falls on the soil?" Some runs off the soil surface, some evaporates back into the air, and the remainder passes through or is held in the soil pore spaces between the soil particles. Explain that when water runs off, it may carry soil particles away (erosion).

Repeat the game above and emphasize what happens if a building, highway, or other solid covering is placed on this soil. What may happen to the pore space? (Move closer together.) What happens to water and air? (It decreases.) What happens to the plant roots and animals living in the soil? (They may disappear.)

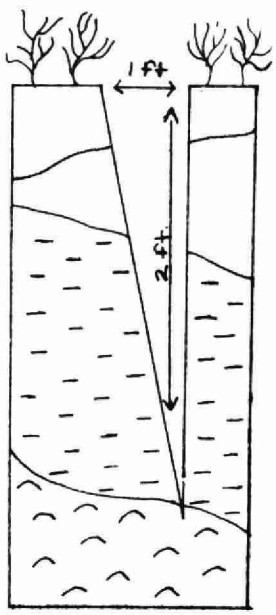
Repeat the soil game and emphasize what happens if grass of other vegetation is planted on bare soil. (Soil pore spaces become larger, more roots grow, and the soil will hold more water and air.)

Further Studies

The study of a soil profile can also be undertaken by children at the primary/intermediate level.

Procedure: Use a spade to dig a hole 12 to 24 inches deep depending on the thickness of the upper layers. Try to make one side of the hole as straight as possible.

A Typical Soil Profile



A Top soil layer, dark brown in color (several inches)

A2 Zone of leaching, light brown in color

B Zone of accumulation, reddish-brown in color (several inches - several feet)

C Parent material, grey brown in color

1. Allow students to look at the hole you have made and ask questions such as: Does the color of the soil change the deeper you dig? Does it feel the same as you dig deeper? Does it look the same as you dig deeper? How far down do the roots grow? Do you think that all soil profiles look the same? Why?

Arts and Crafts

Following a discussion of a soil profile, ask students to construct one of their own. This can be done by using cardboard, various kinds of soil, twigs, leaves, etc.

The "Soil Game" was originally prepared by the Arizona Department of Education, and appeared in the publication "Elementary Teachers Resource Guide for Environmental Education."

The following chart may assist students at the primary/intermediate level to determine soil types.

CHARACTERISTIC	SAND	CLAY	LOAM
Color	light _____	medium _____	dark _____
Grain Size	large _____	tiny _____	medium _____
Humus* Content	slight (if any) _____	moderate _____	rich _____
When rolled through your fingers, it feels	rocky _____	dry: hard & plastic _____ wet: stiff & sticky _____	gritty _____
Speed of water flow allowed by the sample	straight through _____	allows very little, if any _____	moderate to slow _____

* Humus is the black or dark substance in soils formed by the decay of vegetable or animal matter that provides food for plant life.